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A checklist of Rubiaceae species from Eastern Samar, Visayas, Philippines

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Abstract

Samar Island is a center of botanical wealth throughout the Philippine archipelago. However, floristic knowledge of the island is deficient and most of its forested areas remain largely unexplored. Thus, floristic surveys of Rubiaceae members were made on Eastern Samar, located in Visayas, Philippines. Collections were conducted from June 2013 to June 2017 within 5 municipalities: Borongan, Balangkayan, Taft, Guiuan, and Llorente. In total, 59 species belonging to 31 genera representing 21 tribes of the family were recorded. The most species-rich tribes belong to Naucleeae, Psychotrieae, and Spermacoceae, with 10, 8, and 6 species, respectively. Of the 59 species recorded, 37 are endemic to the Philippines. Twelve species are listed as threatened species based on its proposed IUCN category and DAO 2017-11. This study presents an enumeration of Rubiaceae found on selected forested areas of Eastern Samar, Philippines.

Key words

Endangered taxa, floristic survey, forested areas, Gentianales, inventory, Samar Island Natural Park.

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Introduction

The Philippine archipelago has garnered the attention of numerous scientists due to its extremely diverse assemblage of flora and fauna. The Philippines, renowned as a center of biological evolution, was utilized as a model for studying the effects of geographic template on the divisions of biodiversity (Heaney 2007, Brown et al. 2013). The Philippines is also considered as a mega-diverse nation and a hot spot that greatly require global conservation (Brown et al. 2013). However, its regions comprising thousands of islands have not been explored, resulting in a great dearth of data regarding the distributions and identities of numerous organisms dwelling on the archipelago, especially true of the Philippine flora.

Since the end of the Philippine botanical era in the late 1920s, a significant proportion of the plant species have not been re-collected. With the only known collections made by E. Merrill and A. Elmer, many species have consequently been assumed to be extinct (Koopowitz et al. 1998) due to the rapid deforestation that transpired over the last 2 to 5 decades. Merrill made one of the greatest

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contributions to Philippine botany with his renowned work "An Enumeration of Philippine Flowering Plants" (Merrill 1923–1926), but this is nearly a century old and now outdated. Thus, re-collections, updated floristic inventories, and surveys are imminent, especially for areas of priority that require proper conservation and management in the midst of human-driven habitat destruction and the detrimental effects of climate change.

Within the Philippines, Samar Island Natural Park (SINP), which is located in the province of Samar, hosts one of the most diverse floras on the Philippine archipelago. Samar sits on the edge of Eastern Visayas, facing the Pacific Ocean, and together with the neighboring island of Leyte to the west, comprises a unique phytogeographic region in the Philippines. SINP comprises one of the largest areas of old-growth forests known in the country (Patindol 2016). Considered as a center of plant endemism, around 400 endemic species of flowering plants belonging to at least 200 genera are recorded in SINP (Madulid 2000). However, most of the forested areas on the island remain largely unexplored and require protection from abusive land use and alteration.

The coffee family Rubiaceae is regarded as the fourth largest family of angiosperms, and offers a wealthy contribution to the immense biodiversity of the Philippine archipelago. In the most recent global assessment of the family by Davis et al. (2009), the Philippines ranked third among the 20 areas which hold the most number of endemic species and also ranked tenth on the 20 most diverse regions for Rubiaceae (Alejandro and Arriola 2013). Approximately 550 species in about 80 genera are recognized in the Philippines, accounting for 12.1% of the global Rubiaceae. Among the ca 550 species found in the Philippines, 83% are endemic (Davis et al. 2009). With the recent recognition of a new endemic genus, 4 genera are endemic to the country: *Antherostele* Bremek., *Villaria* Rolfe., *Greeniopsis* Merr., and the recently discovered *Kanapia* Alejandro and Arriola (Arriola et al. 2016, Alejandro 2007).

Despite the emergence of studies contributing to the knowledge of the Philippine Rubiaceae, updated floristic inventories are unavailable and lacking. Renowned as a center of plant diversity on the Philippines and throughout Malesia, Samar Island remains considerably unexplored, and thus requires intensive floristic surveys that will contribute to the knowledge of the Philippine flora. Hence, we provide a checklist of Rubiaceae species of Eastern Samar, with notes on their ecology and conservation.

Methods

Study site. With an area covering 466,047 ha, Eastern Samar occupies the eastern division of Samar Island within the Visayas region (Fig. 1). To its northern borders lie Northern Samar, and to the west by Samar. Eastern Samar is faced to the east by the Philippine Sea whereas it is faced by the Leyte Gulf in the south (Lancion 1995). The study site is a thickly vegetative area comprising of mostly old-growth forests, and includes a diverse array of habitats ranging from mangrove forests, lowland evergreen rainforests, and limestone and ultramafic soil forests (Fig. 2). The soil in the forested areas of Eastern Samar is mostly clay loam or clay.

The northeastern region of Samar has the Type II climate, which is characterized by heavy amounts of rainfall with no dry season during December and January. Type IV climate is observed in the Southeastern region of the island, manifesting an even distribution of rainfall throughout the year (Madulid 2000, Patindol 2016). Across the entire Samar island, the climate is humid throughout the year (Kintanar 1984). Considering Samar's geographical position, it suffers heavily from tropical cyclones. Table 1 provides a summary of the specific areas surveyed within the municipalities of Eastern Samar, including the coordinates of each area and the date of all the field activities conducted.

Data collection. The floristic study was done in 5 field expeditions from 2013 to 2017. Purposive sampling of Rubiaceae species were performed along and approximately 10 m adjacent to trails at the study sites. Specimens were collected during their reproductive stages to ensure precise identification of species, processed for herbarium preparation, and deposited vouchers in the University of Santo Tomas Herbarium (USTH). Because existing databases and updated information regarding the flora of Samar are lacking, specimens were identified utilizing original descriptions, taxonomic revisions, and determination keys. Our specimens were also compared to those in the collections of USTH and the Philippine National Herbarium (PNH), to digital type specimens in international herbaria, and from available online resources such as "Co's Digital Flora of the Philippines" (Pelser et al. 2011). The IUCN conservation status of species were indicated in Table 2 and taken from "Co's Digital Flora of the Philippines" (Pelser et al. 2011) and the Department of Environment and Natural Resources Administrative

Table 1. Study sites in Eastern Samar, Philippines.

Date of survey	Municipality	Location	Coordinates
7–15 January 2013	Borongan	Barangay San Gabriel	11°36'26.08"N, 125°16'50.74" E
19–24 June 2015	Balangkayan	Minasangay Island Marine Eco-Park	11°28'24.67" N, 125°31'13.80" E
		Mount Abaca, Barangay Magsaysay	11°26'40.52"N, 125°26'16.88" E
24–28 June 2016	Taft	Maharlika Forest, Barangay San Rafael Villareal	11°51'49.85" N, 125°22'51.36" E
16–24 November 2016	Guian	Homonhon Island	10°47'06.56" N, 125°41'38.04" E
23–27 June 2017	Llorente	Barangay Candoros	11°16'34.25" N, 125°24'25.03" E
		Barangay Magtinio	11°20'32.22" N, 125°20'57.99" E

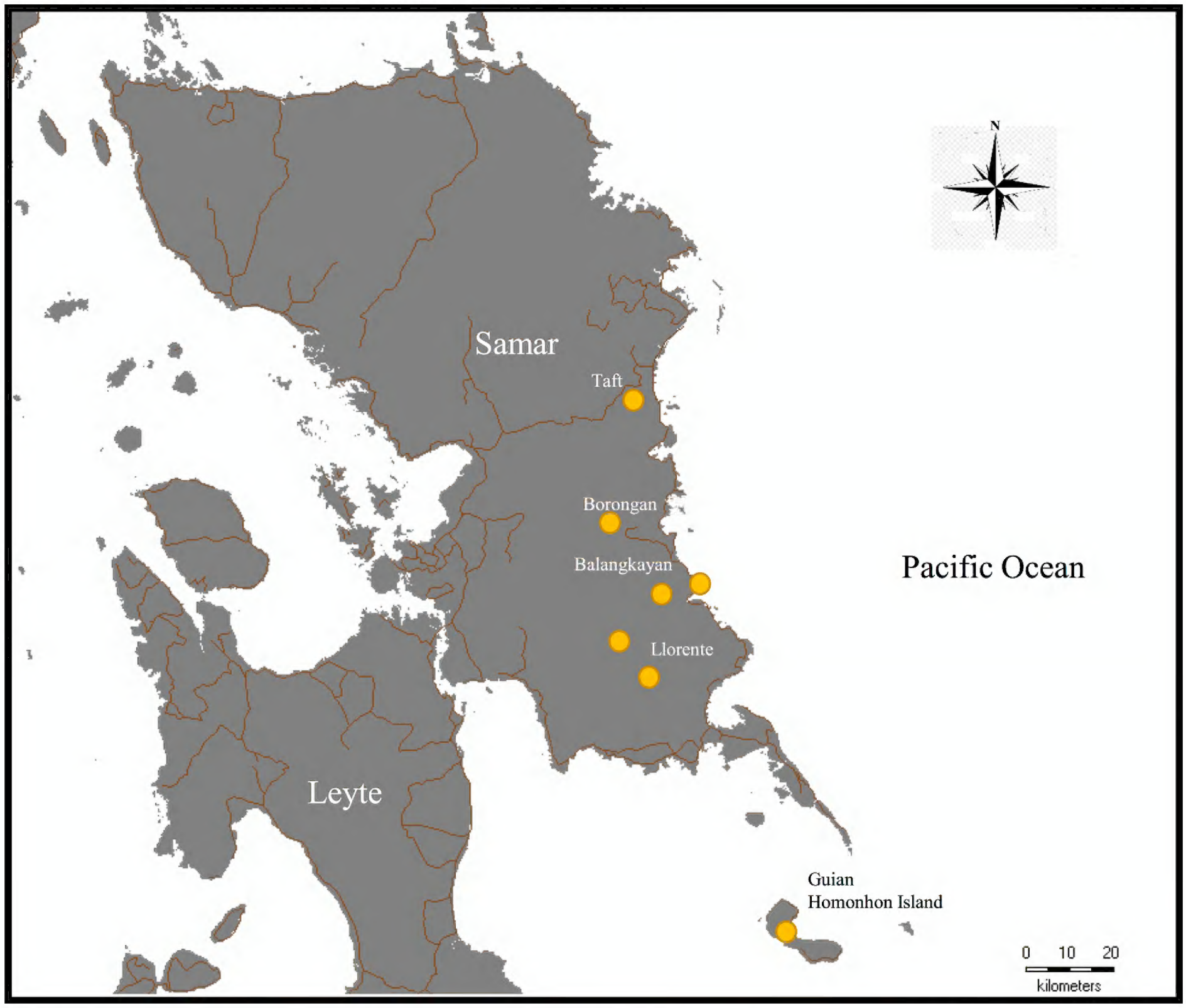

Figure 1. Map of the study sites in Eastern Samar. Areas surveyed are marked in yellow circles.

Order 2017-11 (DENR-DAO 2017-11). Voucher information for the specimens examined, geographic coordinates of collection sites, life form, and endemicity are also noted in Table 2. The list is arranged by tribal level in alphabetical order. The correct scientific names of each species were confirmed by Pelser et al. (2011), IPNI, and The Plant List (2018). Only species that are endemic to the Philippines are provided with notes in our list. DIVA-GIS v. 7.5.0 and Adobe Photoshop CS4 v. 11.0 were used for the preparation of the maps and the figures respectively.

Results

Within Eastern Samar, 59 species of Rubiaceae were recorded belonging to 31 genera and 21 tribes (Table 2). The most diverse tribe in terms of species number was Naucleeae (10 species), followed by Psychotrieae (8), Spermacoceae (6), Urophylleae (4), Aleisantheae (4), Ixoreae (4), Lasiantheae (3), Vanguerieae (3), Guettardeae (2), Mussaendeae (2), and Ophiorrhizeae (2). The tribes Agusteae, Argostemmateae, Coffeae Condamineeae, Gardenieae, Morindeae, Octotropideae, Pavetteae, Prismatorideae, and Schradereae were each represented by a single species. A total of 37 species (62.71%) are identified as endemic to the Philippines. Of the 59 Rubiaceae species inventoried, 28 (42.37%) are shrubs, 17 (28.81%) are trees, 6 (10.17%) are herbs, 6 (10.17%) are vines, and 2 (3.39%) are epiphytes. Twelve species were identified to be threatened based on their proposed IUCN status and the DENR-DAO 2017-11 (2017).

List of species with notes on Philippine endemics

Tribe Agusteae

Wendlandia luzoniensis D.C., Prodr. 4 (1830) 412.

Materials examined. Table 2. Fig. 4G

Small to medium-sized tree about 4–6 m high. Leaves narrowly to widely elliptic, 14–18 × 5–7 cm with a few or scattered hairs on the blades, puberulent on the midrib. Inflorescence terminal, paniculiform, many flowered, puberulent. Calyx 1–1.5 mm, globose to subglobose, puberulent. Corolla tubular, white, lobes 1 mm, tube 3–4 mm. Fruits globose to subglobose, capsular, somehow woody, 1–2 mm, with calyx remnants.

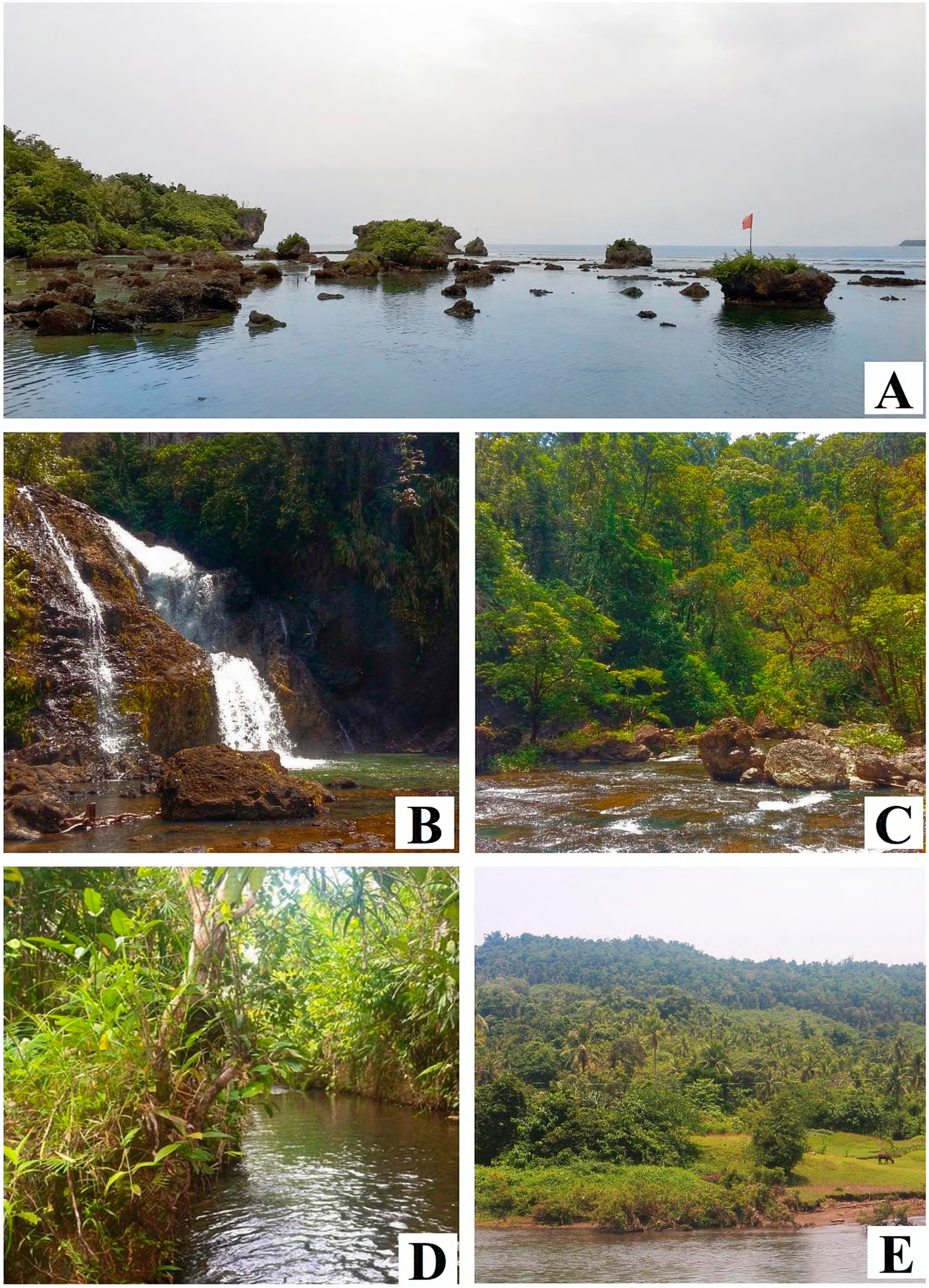

Figure 2. View of selected study sites. **A.** Minasangay Eco-Park, Balangkayan. **B.** Maharlika Falls, Taft. **C.** Maharlika rainforest, Taft. **D.** Brgy. Candoros rainforest, Llorente. **E.** View of rainforest on Brgy. Magtinio, Llorente. Photos taken by J. Ordas and S. Lagasca.

Table 2. List of species identified on the study sites. Vouchers, habit (T = tree, S = shrub, H = herb, V = vine, E = epiphyte), proposed status based IUCN Red List of Threatened Species or the *DENR Administrative Order 2017-11 (NE = Not Evaluated, DD = Data deficient, OT = Other Threatened Species, LC = Least Concern, V = Vulnerable, EN = Endangered, CR = Critically endangered), endemicity (E = Philippine endemic, N = non-endemic) and GPS coordinates are presented.

Species	Voucher	Habit	Status	Endemicity	Latitude (N)	Longitude (E)
Tribe Agusteae						
Wendlandia luzoniensis D.C. (Fig. 4G)	USTH-013345	T	NE	E	11°25′48.58″	125°25′46.85″
Tribe Aleisanthieae						
Greeniopsis discolor Merr. (Fig. 4A)	USTH-013280	T	*CR	E	11°26′37.06″	125°26′32.88″
Greeniopsis euphlebia Merr.	USTH-014329	T	*CR	E	11°20′44.70″	125°27′38.80″
Greeniopsis megalantha Merr.	USTH-014365	T	*CR	E	11°21′11.80″	125°27′16.90″
Greeniopsis multiflora (Elmer) Merr. (Fig. 4C)	USTH-014340	T	EN	E	11°20′43.80″	125°27′38.10″
Tribe Argostemmateae						
Argostemma maquilingense Elmer	USTH-013973	H	NE	E	11°49′19.02″	125°17′04.99″
Tribe Coffeae						
Diplospora tinagoensis (Elmer) Ali & Robbrect	USTH-014457	S	NE	N	11°36′26.08″	125°16′50.74″
Tribe Condamineeae						
Dolicholobium philippinense Trelease (Fig. 5F)	USTH-013960	T	NE	E	11°49′43.27″	125°16′53.19″
Tribe Guettardeae						
Guettarda speciosa L.	USTH-014369	T	NE	N	11°25′53.40″	125°25′38.33″
Timonius philippinensis Merr. (Fig. 6E)	USTH-013331	T	NE	E	11°25′53.99″	125°25′39.47″
Tribe Gardenieae						
Aidia pulcherrima (Merr.) Ridsdale (Fig. 4F)	USTH-013268	V	NE	E	11°25′57.13″	125°25′28.81″
Tribe Ixoreae						
Ixora bartlingii Elmer (Fig. 3E)	USTH-013285	S	NE	E	11°26′10.98″	125°25′36.37″
Ixora longifolia Sm. in A. Rees (Fig. 4E)	USTH-013296	S	NE	N	11°28′26.21″	125°31′10.94″
Ixora salicifolia (Blume) D.C.	USTH-013954	S	NE	N	11°49′23.48″	125°17′00.38″
Ixora silagoensis Banag, Manalastas & Alejandro	USTH-013965	S	CR	E	11°49′22.03″	125°17′00.87″
Tribe Lasiantheae						
Lasianthus attenuatus Jack (Fig. 6F)	USTH-013967	S	NE	N	11°49′20.59″	125°17′00.90″
Lasianthus hirsutus (Roxb.) Merr. (Fig. 7F)	USTH-013945	S	NE	N	11°49′19.14″	125°17′08.29″
Lasianthus verticillatus (Lour.) Merr.	USTH-013956	T	NE	N	11°49′19.51″	125°17′07.78″
Tribe Morindeae						
Morinda citrifolia L. (Fig. 7A)	USTH-013330	S	NE	N	11°28′24.86″	125°31′15.47″
Tribe Mussaendeae						
Mussaenda philippica var. *philippica* A. Rich (Fig. 6C)	USTH-013951	S	NE	N	11°49′43.43″	125°16′53.19″
Mussaenda vidalii Elmer.	USTH-014344	T	*VU	E	11°22′13.00″	125°26′07.40″
Tribe Naucleeae						
Neonauclea bartlingii var. *cumingiana* (S.Vidal) Ridsdale	USTH-014368	T	NE	E	11°16′34.25″	125°24′25.03″
Neonauclea jagorii (Merr.) Merr. (Fig. 3F)	USTH-013961	S	NE	E	11°49′20.20″	125°17′03.17″
Neonauclea lanceolata subsp. *gracilis* (S. Vidal) Ridsdale (Fig. 5A)	USTH-013292	T	NE	N	11°25′50.43″	125°25′40.13″
Neonauclea viridiflora Ordas, Banag, Alejandro (Fig. 6A)	USTH-013060	T	EN	E	11°49′19.74″	125°17′01.63″
Neonauclea wenzelii (Merr.) Merr.	USTH-014461	T	NE	E	11°36′26.08″	125°16′50.74″
Uncaria attenuata Korth.	USTH-014346	V	NE	N	11°22′11.60″	125°26′02.90″
Uncaria cordata (Lour.) Merr. (Fig. 3A)	USTH-014362	V	NE	N	11°21′55.60″	125°25′57.60″
Uncaria lanosa Wall. in Roxb.	USTH-013336	V	NE	N	11°26′42.04″	125°26′16.80″
Uncaria longiflora (Poir.) Merr.	USTH-013941	V	NE	N	11°49′27.04″	125°17′59.81″
Uncaria nervosa Elmer	USTH-014330	V	NE	N	11°20′44.30″	125°27′38.20″
Tribe Octotropideae						
Hypobathrum purpureum (Elmer) Merr.	USTH-014447	S	NE	E	11°36′26.08″	125°16′50.74″
Tribe Ophiorrhizeae						
Ophiorrhiza acuminata DC. (Fig. 3D)	USTH-013974	H	NE	E	11°49′33.51″	125°17′01.44″
Ophiorrhiza camiguinensis Elmer (Fig. 3C)	USTH-013974	S	NE	E	11°49′18.26″	125°17′07.46″
Tribe Pavetteae						
Tarenna luzoniensis (S. Vidal) Bremek.(Fig. 4B)	USTH-013959	T	NE	E	11°49′26.64″	125°17′00.34″
Tribe Prismatorideae						
Prismatomeris tetrandra (Roxb.) K. Schum.	USTH-014334	S	NE	N	11°20′37.30″	125°27′36.70″
Tribe Psychotrieae						
Hydnophytum leytense Merr.	USTH-014454	E	*OT	E	11°36′26.08″	125°16′50.74″
Myrmecodia tuberosa Jack (Fig. 7C)	USTH-013962	E	NE	N	11°49′19.08″	125°17′06.78″
Psychotria conglomeratiflora Sohmer & Davis	USTH-014446	S	CR	E	11°36′26.08″	125°16′50.74″
Psychotria membranifolia Bartl. ex D.C. (Fig. 6D)	USTH-014335	S	NE	N	11°20′44.70″	125°27′38.80″
Psychotria paloensis var. *subelliptifolia* Sohmer & Davis (Fig. 7E)	USTH-013313	S	CR	E	11°28′25.99″	125°31′10.96″

Continued.

Table 2. *Continued.*

Species	Voucher	Habit	Status	Endemicity	Latitude (N)	Longitude (E)
Psychotria papillata (Merr.) Merr.	USTH-014450	S	VU	E	11°36′26.08″	125°16′50.74″
Psychotria radicans (Merr.) Merr.	USTH-013964	S	VU	E	11°49′18.12″	125°17′06.17″
Psychotria wenzelii (Merr.) Merr.	USTH-013312	S	CR	E	11°25′50.41″	125°25′47.43″
Tribe Schradereae						
Schradera monocephala (Merr.) Puff, Buchner & Greimler (Fig. 7D)	USTH-014355	S	NE	E	11°22′03.10″	125°25′55.70″
Tribe Spermococeae						
Exallage auricularia (L.) Bremek.	USTH-013943	H	NE	N	11°49′19.94″	125°17′05.60″
Exallage buruensis (Miq.) Bremek.	USTH-013952	H	NE	N	11°49′21.88″	125°17′00.85″
Exallage costata (Roxb.) Bremek. (Fig. 5E)	USTH-013949	H	NE	N	11°49′21.37″	125°17′01.16″
Hedyotis longipedunculata Merr. (Fig. 7B)	USTH-013957	S	NE	E	11°49′20.15″	125°17′01.47″
Hedyotis phanerophlebia Merr. (Fig. 5D)	USTH-014345	S	NE	E	11°26′37.06″	125°25′57.20″
Spermacoce remota Lam. (Fig. 6B)	USTH-013947	H	NE	N	11°49′20.32″	125°17′06.08″
Tribe Urophylleae						
Antherostele grandistipula (Merr.) Bremek. (Fig. 5B)	USTH-013271	S	*EN	E	11°26′11.44″	125°25′35.99″
Praravinia stenophylla (Merr.) Bremek.	USTH-014331	T	NE	E	11°20′44.00″	125°27′38.10″
Praravinia triflora (Quisumb. & Merr.) Bremek.	USTH-014449	T	NE	E	11°36′26.08″	125°16′50.74″
Urophyllum memecyloides (C. Presl) S. Vidal (Fig. 5C)	USTH-014331	S	NE	E	11°22′03.50″	125°25′56.10″
Urophyllum urdanetense Elmer	USTH-013966	S	NE	E	11°49′25.48″	125°17′00.13″
Tribe Vanguerieae						
Canthium glandulosum (Blanco) Merr.	USTH-013966	S	NE	E	11°49′23.50″	125°17′00.34″
Psydrax amplifolia (Elmer) Davis	USTH-014443	S	NE	E	11°36′26.08″	125°16′50.74″
Pyrostria elmeri (Merr.) Arriola, Meve, Alejandro (Fig. 4D)	USTH-014323	S	NE	E	11°20′44.70″	125°27′38.80″

Wendlandia luzoniensis is widely distributed on the Philippines, inhabiting low to medium elevation, primary and secondary forests. However, this is the first report of this species occurring in the Visayas.

Tribe Aleisanthieae

Greeniopsis discolor Merr., PJS 12 c (1917) Bot. 163.

Materials examined. Table 2. Fig. 4A

Small tree about 5 m high. Leaves elliptic, 15–26 × 5–10 cm, subcoriaceous, with densely hairy abaxially. Inflorescences terminal, pubescent, many-flowered. Calyx 2 mm, obtuse, puberulous. Corolla white, rarely yellow, campanulate, densely pubescent, lobes 1 mm, tube 3–4 mm. Fruits ellipsoid, 4 mm, brown, pubescent, with calyx remnants.

This species is highly similar to *G. multiflora* and *G. pubescens* in terms of reproductive structures, but is easily distinguished by its white, woolly hairs on the abaxial surface of the leaf (Alejandro et al. 2010).

Greeniopsis euphlebia Merr., PJS 17 (1921) 319.

Materials examined. Table 2.

Shrub about 3 m high, pubescent. Leaves broadly elliptic, 20–22 × 6–10 cm, subcoriaceous, densely hairy abaxially. Inflorescences terminal, pubescent, many-flowered. Calyx 5 mm, obtuse, pubescent. Corolla white, rarely yellow, campanulate, pubescent outside, lobes 2 mm, tube 4–5 mm. Fruits ellipsoid, 8 mm, brown, pubescent, with calyx remnants.

This species is distinguished from other *Greeniopsis* by its sunken secondary veins adaxially on its leaves and its leaf indumentums (Alejandro et al. 2010).

Greeniopsis megalantha Merr., PJS 12 c (1917) Bot. 164.

Materials examined. Table 2.

Medium-sized tree about 9 m high. Leaves elliptic to lanceolate, 15–20 × 5–6 cm, coriaceous, glabrous but with sparse hairs on the midrib. Inflorescences terminal, pubescent, many-flowered. Calyx 6 mm, rhomboid, pubescent. Corolla white, urceolate, pubescent outside, lobes 3 mm, tube 4 mm. Fruits ellipsoid, 7–10 mm, brown, pubescent.

This species has the largest flowers compared to all *Greeniopsis* species and is easily recognized by its somewhat glabrous leaves and stipules (Alejandro et al. 2010).

Greeniopsis multiflora (Elmer) Merr., PJS 4 c (1909) Bot. 325.

Materials examined. Table 2. Fig. 4C

Shrub about 2 m high, pubescent. Leaves elliptic to obovate, 20–25 × 10–15 cm, glabrous with scattered hairs on midrib. Inflorescences terminal, sparsely pubescent, many-flowered. Calyx 2 mm, rhomboid, pubescent. Corolla white, urceolate, pubescent outside, lobes 1 mm, tube 1–2 mm. Fruits subglobose, 4–5 mm, brown, pubescent, with calyx remnants.

In contrast to the other *Greeniopsis* species found in Eastern Samar and assessed as Critically Endangered, *G. multiflora* is very widespread across the Philippines.

Tribe Argostemmateae

Argostemma maquilingense Elmer, LPB 9 (1934) 3242.

Materials examined. Table 2.

Small herb about 5–7 cm high. Leaves oblong to

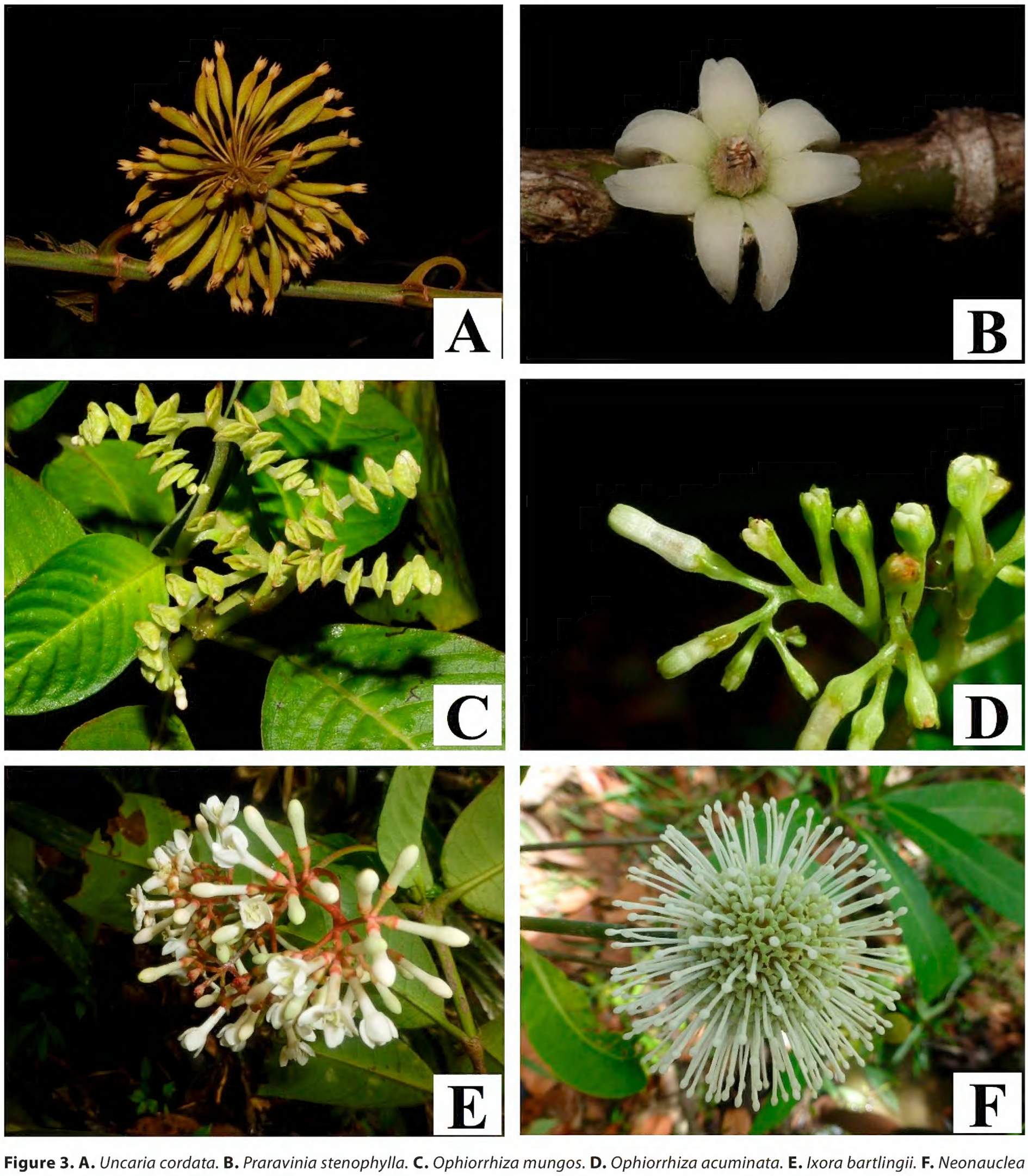

Figure 3. A. *Uncaria cordata.* **B.** *Praravinia stenophylla.* **C.** *Ophiorrhiza mungos.* **D.** *Ophiorrhiza acuminata.* **E.** *Ixora bartlingii.* **F.** *Neonauclea jagorii.* Photos taken by R. Docot, S. G. Zamudio, and C. Banag.

obovate, 3 × 1–2 cm, very membranous, glabrous on both sides, except for midrib that is somewhat puberulent. Infructescences solitary or in 2 to 3 fruits, terminal. Flowers not seen. Fruits globose to subglobose, 4 mm in diameter, crowned with calyx remnants, green.

Named after its type locality on Mount Makiling, Laguna, this species is also reported on Mount Bulusan, Sorsogon, on the island of Luzon north of Samar. The species is known to be ecologically restricted to wet, mossy forest summits. Hence, our new observation represents a new occurrence of this species, inhabiting moist, lowland rainforests.

Tribe Coffeae

Diplospora tinagoensis (Elmer) Ali & Robbrect, Blumea 35 (1991) 299.

Materials examined. Table 2.

Tribe Condamineeae

Dolicholobium philippinense Trelease, LPB 3 (1911) 984.

Materials examined. Table 2. Fig. 5F

Small tree about 5 m high, stems somewhat villous. Leaves elliptical, 12 × 5–6 cm, with conspicuous hairs

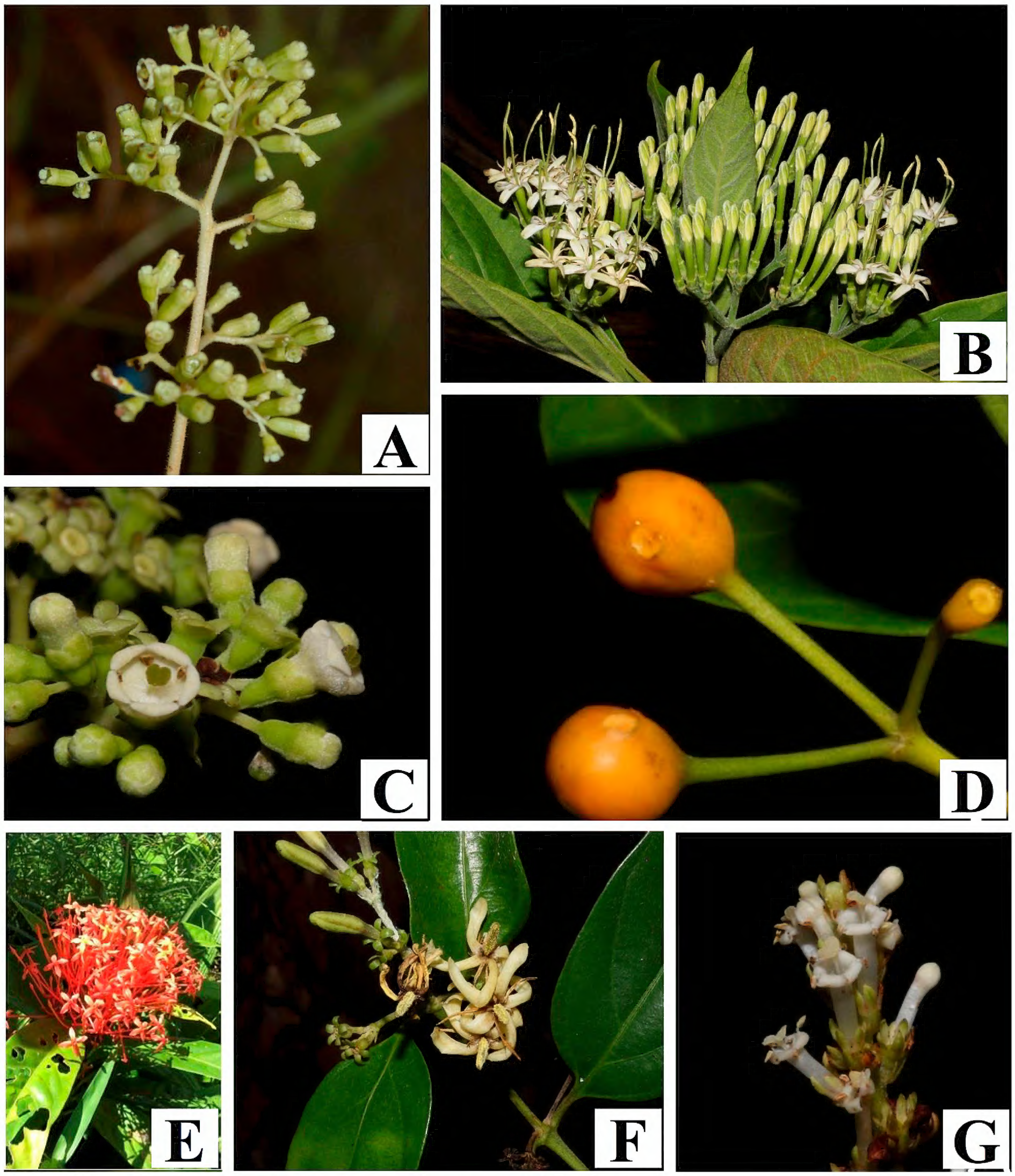

Figure 4. A. *Greeniopsis discolor.* **B.** *Tarenna luzionensis.* **C.** *Greeniopsis multiflora.* **D.** *Pyrostria elmerii.* **E.** *Ixora longifolia.* **F.** *Aidia pulcherrima.* **G.** *Wendlandia luzoniensis.* Photos taken by R. Docot, S. G. Zamudio, and C. Banag.

along the midrib. Inflorescences lateral on ultimate branches, 2–3 flowered. Calyx shortly lobed about 2 mm. Corolla yellowish-white to white, lobes 9–10 × 6 mm, tube 4–5 mm. Fruits not seen.

Of the 28 known species of this genus, *Dolicholobium philippinense* is the only species recorded on the Philippines.This species thrives in forests along river banks. Variability on the indumentums on the vegetative structure differ among individuals, as stated by Jansen and Ridsdale (1983).

Tribe Guettardeae

Guettarda speciosa L., Sp. Pl. (1753) 991.

Materials examined. Table 2.

Timonius philippinensis Merr., Philipp. Bur. Forestry Bull. 1 (1903) 54.

Materials examined. Table 2. Fig. 6E

Small tree about 3 m high. Leaves ovate-lanceolate, 9–11 × 2.8–5.5 cm, glabrous. Inflorescence axillary, with

5–6 flowers. Calyx globose, 7 mm in diameter. Corolla salver-form, white, lobes 3 mm, tube 7 mm. Fruits not seen.

This endemic species is widely distributed on the Philippines, thriving in lowland and beach forests.

Tribe Gardenieae

Aidia pulcherrima (Merr.) Ridsdale, Blumea 41 (1996) 173.

Materials examined. Table 2. Fig. 4F

Vine or scandent shrub, about 5 m high. Leaves elliptic to oblong, 16–20 × 5–8 cm, coriaceous, glabrous. Inflorescences in axillary cymes, with 5–8 flowers. Calyx funnel-shaped, 15 mm long. Corolla white to pink, lobes 8–10 mm, tube 10 mm. Fruits ellipsoid, 12–15 mm, yellowish, glabrous.

This endemic species recorded only in certain areas of Southern Luzon, Negros and in Mindanao. This is a first report of this species occurring on Eastern Samar.

Tribe Ixoreae

Ixora bartlingii Elmer, LPB 3 (1911) 1020.

Materials examined. Table 2. Fig. 3E

Small tree about 4 m high. Leaves elliptic to oblong, 20–25 × 7–10 cm, membranous. Inflorescences terminal, pendulous, trichotomously branched. Calyx shortly triangular. Corolla white, lobes 4–6 mm, tube 10–15 mm. Fruits globose, 5–7 mm in diameter, red to pink.

This endemic species is widely distributed across the archipelago. It is easily distinguished from other *Ixora* species in the study area by its terminal, pendulous, red inflorescences.

Ixora longifolia Sm. in A. Rees, Cycl. 19 (1811) no. 3.

Materials examined. Table 2. Fig. 4E

Ixora salicifolia (Blume) D.C., Prodr. 4 (1830) 487.

Materials examined. Table 2.

Ixora silagoensis Banag, Manalastas & Alejandro, Nordic Journal of Botany 32 (2014) 763.

Materials examined. Table 2.

Shrub about 1 m high. Leaves, sessile, erect, linear, 27–30 × 1–3 cm, coriaceous. Inflorescences shortly peduncled, red. Calyces narrowly triangular, 2–3 m, red. Corolla white, tinged with pink on lobes, lobes 10 mm, tube 40–45 mm. Fruits subglobose, 0.5–1 cm in diameter, red.

Ixora silagoensis was discovered in the municipality of Silago on southern Leyte in 2012 and was reported as a Critically Endangered species (Banag et al. 2014). Numerous populations of this species occur on Eastern Samar, particularly in lowland primary forests. It resembles *I. auriculata* but is distinguished by its fruits and flowers. The geographic distributions of these species also differ; *I. auriculata* occurs on Luzon whereas *I. silagoensis* occurs on Samar and Leyte (Banag et al. 2014).

Tribe Lasiantheae

Lasianthus attenuatus Jack, Trans. Linn. Soc. 14 (1823) 126.

Materials examined. Table 2. Fig. 6F

Lasianthus hirsutus (Roxb.) Merr., J. Arnold Arb. 33 (1952) 229.

Materials examined. Table 2. Fig. 7F

Lasianthus verticillatus (Lour.) Merr., Trans. Am. Phil. Soc. n. s. 24, 2 (1935) 372.

Materials examined. Table 2.

Tribe Morindeae

Morinda citrifolia L., Sp. Pl. (1753) 176.

Materials examined. Table 2. Fig. 7A

Tribe Mussaendeae

Mussaenda philippica* var. *philippica A. Rich., Mém. Rubiac. (1830) 165.

Materials examined. Table 2. Fig. 6C

Mussaenda vidalii Elmer, LPB 3 (1911) 993.

Materials examined. Table 2.

Small shrub about 1 m high. Leaves ovate, 2–2.5 × 1.2–1.5 cm, membranous, densely hirsute on both sides especially on the venations. Inflorescences terminal, spreading corymbs. Calyx with a single swollen lobe (calycophyll), white, broadly ovate, 6–8 × 3–8 cm, sparsely pubescent. Corolla infundibular, lobes 4–6 mm, tube 2–3 cm, orange to yellow. Fruits ellipsoid, 1–2 cm, with dense warts.

This species is often observed on secondary forests or in open-regrowth forests of Eastern Samar. While the type specimen of *M. vidalii* is described as a scandent shrub, most collections of this species are represented by erect shrubs or small trees. In their revision, Alejandro et al. (2015), they noted phenotypic variability of the habit of this species, which ranges from scandent shrubs to small, erect shrubs or trees.

Tribe Naucleeae

Neonauclea bartlingii* var. *cumingiana (S.Vidal) Ridsdale, Blumea 34 (1989) 219.

Materials examined. Table 2.

Small tree about 4 m high, without myrmedomes on ultimate branches. Leaves ovate-elliptic, 12–21 × 3–6 cm, coriaceous. Diameter of mature flowering heads across corollas 30–40 mm. Calyx with well-developed appendages, 3–4 mm deciduous. Corolla infundibular, yellow, lobes 1–1.3 mm, tube 6–11 mm. Fruiting head woody, 20–23 mm in diameter.

This endemic species is distributed throughout the Philippines. The color of the flowers, however, vary,

Figure 5. A. *Neonauclea lanceolata* subsp. *gracilis*. **B.** *Antherostele grandistipula*. **C.** *Urophyllum memecyloides*. **D.** *Hedyotis phanerophlebia*. **E.** *Exallage costata*. **F.** *Dolicholobium philippinense*. Photos taken by R. Docot, S. G. Zamudio, and C. Banag.

ranging from white, light-purple, and pink. Most *Neonauclea* species in Eastern Samar (except *N. wenzellii*) have yellow flowers.

Neonauclea jagorii (Merr.) Merr., J. Wash. Acad. Sci. 5 (1915) 540.

Materials examined. Table 2. Fig. 3F

Small rheophytic shrub less than 1 m high. Leaves linear-lanceolate, 14–20 × 1–2.5 cm, coriaceous. Diameter of mature flowering heads across corollas 35–38 mm. Calyx with well-developed appendages, 3–4 mm deciduous. Corolla infundibular, yellow, lobes 1 mm, tube 8–10 mm. Fruiting head woody, 20–23 mm in diameter.

This species is a Philippine endemic which is reported only from Samar and Camarines Sur. It is one of the few species of *Neonauclea* that exhibit rheophytism and is quite abundant on rivers and on streams of Eastern Samar. It is easily recognizable by other *Neonauclea* species in having its linear-lanceolate leaves and a rheophytic habit.

Neonauclea lanceolata* subsp. *gracilis (S. Vidal) Ridsdale, Blumea 34 (1989) 225.

Materials examined. Table 2. Fig. 5A

Neonauclea viridiflora Ordas, Banag, Alejandro, Systematic Botany 42 (2017) 364.

Materials examined. Table 2. Fig. 6A

Small to medium-sized trees about 6–8 m high, with myrmedomes on ultimate branches. Leaves broadly elliptic, 19–20.2 × 9.5–14.5 cm, coriaceous. Diameter of mature flowering heads across corollas 35–37 mm. Calyx with well-developed appendages, about 7–8 mm, deciduous. Corolla infundibular, yellow, tube 2.5 mm, lobes 1 mm. Fruiting head woody, 23–30 mm in diameter.

Eastern Samar is the type locality for this species, which is abundant there. It is easily mistaken as *N. formicaria* or *N. connicalycina* based on its habit, vegetative parts, and the presence of myrmedomes, but *N. viridiflora* greatly differs in its reproductive morphology. The species tends to display minor differences in its leaf morphology, and individuals found near rivers have much smaller and narrower leaves compared to those found in dry areas.

Neonauclea wenzelii (Merr.) Merr., J. Wash. Acad. Sci. 5 (1915) 542.

Materials examined. Table 2.

Medium-sized tree about 6–8 m high, with myrmedomes on ultimate branches. Leaves broadly-elliptic, 13–20 × 8–16 cm, prominently veined with conspicuous hairs, deep brown to red. Diameter of mature flowering heads across corollas 35 mm. Calyces with well-developed appendages, about 6 mm, deciduous. Corolla densely hairy, purple, tube 8 mm, lobes 2–3 mm. Fruiting head woody, 30 mm in diameter, prominently crowned with calyx remnants.

This species is a narrow endemic of the Samar and Leyte islands. According to Merrill (1914) and Ridsdale (1989), this is the sole species of *Neonauclea* having six-merous flowers. Our specimen had only 5 lobes, and it is likely that *N. wenzelii* tends to exhibit five- to six-merous flowers on different individuals.

Uncaria attenuata Korth., Verh. Nat. Gesch. Ned. Bot. (1840) 170.

Materials examined. Table 2.

Uncaria cordata (Lour.) Merr., Interp. Herb. Amb. (1917) 479.

Materials examined. Table 2. Fig. 3A

Uncaria lanosa Wall. in Roxb., Fl. Ind. 2 (1824) 131.

Materials examined. Table 2.

Uncaria longiflora (Poir.) Merr., Interp. Herb. Amb. (1917) 480.

Materials examined. Table 2.

Tribe Octotropidae

Hypobathrum purpureum (Elmer) Merr., EPFP 3 (1923) 534.

Materials examined. Table 2.

Medium-sized shrub about 3 m high. Leaves lanceolate, 10–12 × 4 cm subcoriaceous, and glabrous. Inflorescences axillary, solitary or in few-flowered glabrous cymes. Calyx turbinate, 2.5 mm. Corolla white, 2–3 mm. Fruits not seen.

Based on its original description, *H. purpureum* is characterized by having inflorescences with few- to many-flowered cymes. Our collection of this species in Eastern Samar has solitary or few-flowered axillary cymes. The morphology of this specimen, however, is highly similar overall. Similar individuals having solitary and few-flowered inflorescences were observed from the Province of Cagayan, Luzon (Pelser et al. 2011).

Tribe Ophiorrhizeae

Ophiorrhiza acuminata DC., Prodr. 4 (1830) 416.

Materials examined. Table 2. Fig. 3D

Small to medium-sized herb less than 1 m high, branching starts at upper portion of stem, forming dense cluster of leaves. Leaves elliptic, glabrous, membranous, apex strongly acuminate, base attenuate, somewhat decurrent. Inflorescence terminal cymes. Flowers white. Fruits loculicidally dehiscent.

The species was only known from its type locality at Sorsogon, Luzon. This species however, is regarded as a "dubious taxon" by Pelser et al. (2011) based on the accounts of Merrill (1923) wherein he indicated "the type is a specimen collected at Sorsogon, Luzon, by Haenke. I know the species only by description". Nevertheless this species is accepted, and we were able to re-collect it outside its type locality.

Ophiorrhiza camiguinensis Elmer, LPB 5 (1913) 1881.

Materials examined. Table 2. Fig. 3C

Shrubs of about 60–80 cm high, very loose branching and leaves usually found at terminal ends. Leaves narrowly elliptic, 12–16 × 2–4.6 cm, glabrous but with sparse trichomes, distinctly red when dry. Inflorescences terminal, branching from a main axis, numerous flowers. Corolla white, red when dry. Fruits capsular, 1.5–2 mm wide, green, red when dry.

This Philippine endemic occurs on lowland primary forests in moist areas or along streams. It was previously observed only on Mindanao.

Tribe Pavetteae

Tarenna luzoniensis (S.Vidal) Bremek., Repert. Spec. Nov. Regni Veg. 37 (1934) 198.

Materials examined. Table 2. Fig. 4B

Tree about 10 m high high. Leaves elliptic, 12–15 × 4.5–6 cm, glabrous, coriaceous. Inflorescences terminal.

Figure 6. A. *Neonauclea viridiflora*. **B.** *Spermococe remota*. **C.** *Mussaenda philippica*. **D.** *Psychotria membranifolia*. **E.** *Timonius philippinensis*. **F.** *Lasianthus attenuatus*. Photos taken by R. Docot, S. G. Zamudio, and C. Banag.

Flowers numerous in umbel clusters, white to dirty-white. Fruits not seen.

This endemic species is widespread across the Philippines, thriving in lowland primary forests.

Tribe Prismatorideae

Prismatomeris tetrandra (Roxb.) K. Schum. in Engl. & Prantl, Nat. Pflanzenfam. 4 (1891) 138.

Materials examined. Table 2.

Tribe Psychotrieae

Hydnophytum leytense Merr. PJS 8 (1913) Bot. 390.

Materials examined. Table 2.

Epiphytic, myrmecophytic shrub about 60 cm high. Leaves oblong, 5–8 × 1–3 cm, coriaceous, glabrous. Inflorescences axillary. Flowers not seen. Fruits ovoid, 5 mm long, fleshy, red. This species occurs on Laguna, Sorsogon, and Leyte on lowland undisturbed forests. DENR-DAO (2017) classified this species under "Other

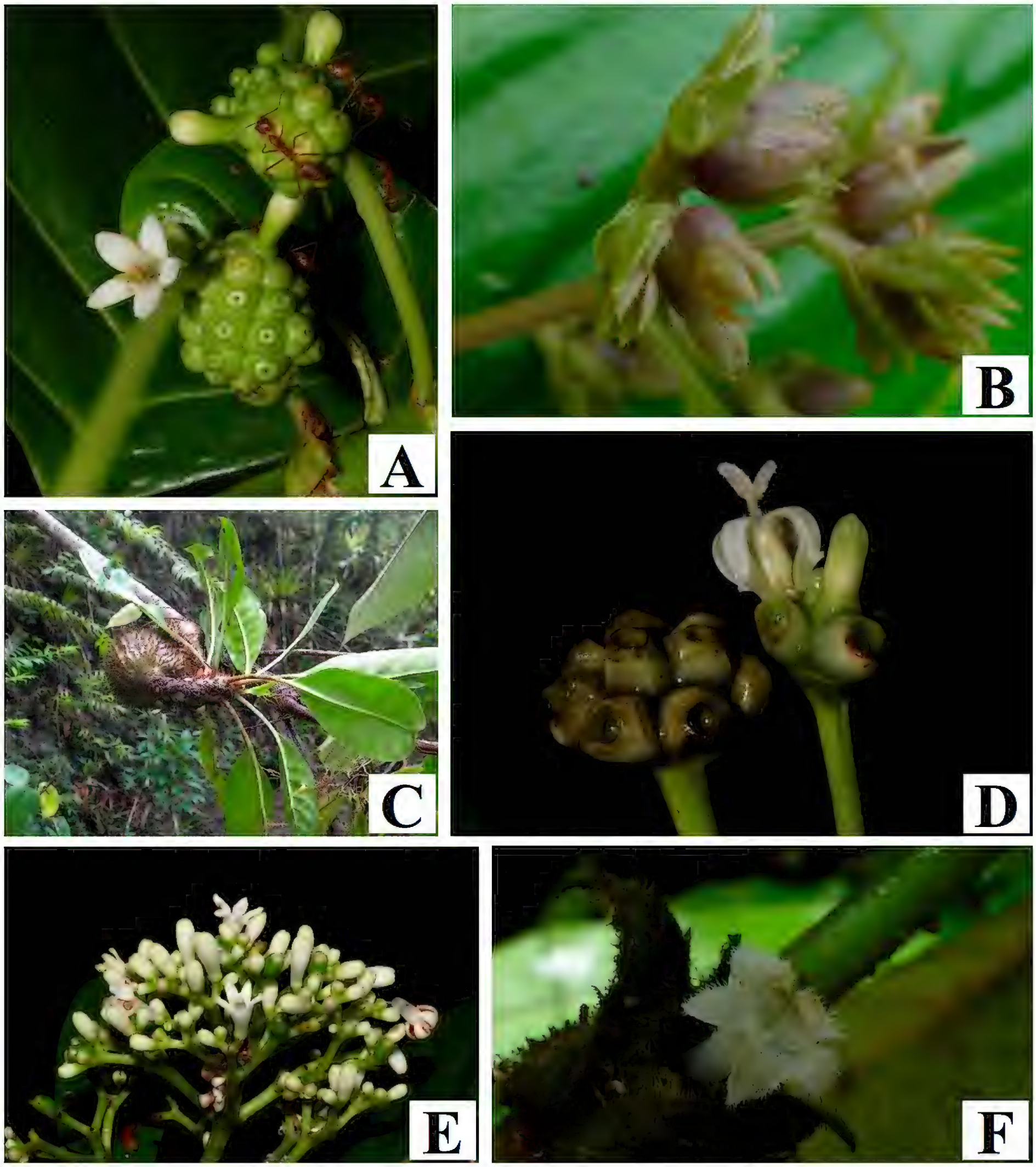

Figure 7. A. *Morinda citrifolia*. **B.** *Hedyotis longipedunculata*. **C.** *Myrmecodia tuberosa*. **D.** *Schradera monocephala*. **E.** *Psychotria paloensis* var. *subelliptifolia*. **F.** *Lasianthus hirtus*. Photos taken by R. Docot, S. G. Zamudio, and C. Banag.

threatened species", but its numbers may decline with the loss of its hosts due to deforestation.

Myrmecodia tuberosa Jack, Trans. Linn. Soc. London 14 (1823) 123.

Materials examined. Table 2. Fig. 7C

Psychotria conglomeratiflora Sohmer & A.P.Davis, Sida Bot. Misc. 27 (2007) 120.

Materials examined. Table 2.

Medium-sized shrub about 2–3 m high. Leaves oblanceolate-oblong, 30–34 × 10–12 cm, coriaceous, glabrous. Infructescences trichotomous, but appearing monochotomous, with many fruits. Flowers not seen. Fruits obovoid, dark purple, glabrous, 8 mm, with prominent longitudinal ridges. This species is very distinct from other species of Philippine *Psychotria* by its prominently large leaves and unique inflorescences.

This species was originally described from Samar. It was initially classified as a Critically Endangered or a possibly Extinct species (Sohmer and Davis 2007), so our rediscovery of this remarkable species is important.

Psychotria membranifolia Bartl. ex DC., Prodr. 4 (1830) 522.

Materials examined. Table 2. Fig. 6D

Psychotria paloensis* var. *subelliptifolia Sohmer & Davis, Sida Bot. Misc. 27 (2007) 199.

Materials examined. Table 2. Fig. 7E

Medium-sized shrub about 3 m high. Leaves oblanceolate, with hairs along the midrib below. Infructescences monochotomously branching, puberulent. Flowers not seen. Fruits obovoid, with distinct longitudinal ridges, orange to dark red.

According to Sohmer and Davis (2007), this variety was only collected once, from its type locality at Lake Danao, Ormoc, Leyte in 1950. Because this variety is very rare and has not been re-collected, they classified it as Critically Endangered, or possibly Extinct. Our re-collection of this taxon outside of its type locality proves that there are existing populations scattered throughout the Samar and Leyte islands. The species is occurs throughout the Philippines with 5 known varieties.

Psychotria papillata (Merr.) Merr.

Materials examined. Table 2.

Shrub about 1–2 m high, very pubescent all throughout. Leaves elliptic, 8–10 × 2–4 cm, chartaceous, pubescent. Infructescences terminal, sessile, pubescent. Flowers not seen. Fruits black, obovoid, 7–8 mm, pubescent. *Psychotria papillata* is one of the few species in the Philippines easily recognized by its sessile inflorescence and its densely pubescent leaves.

Psychotria radicans (Merr.) Merr., EPFP 3 (1923) 560.

Materials examined. Table 2.

Scandent shrub about 2 m high. Leaves oblong-lanceolate, 8–10 × 3–4 cm, subcoriaceous, glabrous. Flowers not seen. Fruits globose, 5–6 mm, glabrous, red or orange.

This species is endemic to both Samar and Leyte and had not been re-collected since its discovery. It is easily recognized from other *Psychotria* species in the area by its climbing habit. The flower morphology remains unknown.

Psychotria wenzelii (Merr.) Merr. EPFP 3 (1923) 564.

Materials examined. Table 2.

Medium-sized shrub about 3 m high, glabrous throughout. Leaves elliptic to obovate, chartaceous. Inflorescence trichotomously-branching. Flowers white, 4 to 5-merous, glabrous outside, villose within corolla tube. Fruits globose, smooth, orange to dark red or black.

According to Sohmer and Davis (2007), this species was collected only once in 1914 on Jaro, Leyte, which led to its status as a Critically Endangered or possibly Extinct. However, its presence on Samar is proof of an extended geographic distribution beyond its type locality. This species closely resembles *P. pauciflora* Bartl. ex DC but is distinguished by having sessile or subsessile flowers and fruits.

Tribe Schradereae

Schradera monocephala (Merr.) Puff, Buchner & Greimler, Blumea 43 (1998) 299.

Materials examined. Table 2. Fig. 7D

Tall shrub about 5 m high. Leaves oblong-elliptic to lanceolate, thick and subcoriaceous, nerves not prominent on both sides. Inflorescence axillary, globose heads. Calyx truncate. Flower white, valvate. Fruits brownish, with calyx remnant.

This species is widespread on the Philippines, but this is the first report of its occurrence on Samar. It is commonly mistaken as a species of *Morinda* due to similar infructescences. Only 2 *Schradera* species, both endemics, are currently recognized in the Philippines; *S. elmeri* Puff, Buchner & Greimler is restricted to the province of Davao in Mindanao. . *Schradera monocephala* is easily recognizable from *S. elmeri* by its leaves that have inconspicuous nerves and fruitlets that appear to be completely free from each other.

Tribe Spermacoceae

Exallage auricularia (L.) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 48(2) (1952) 142.

Materials examined. Table 2.

Exallage buruensis (Miq.) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 48(2) (1952) 142.

Materials examined. Table 2.

Exallage costata (Roxb.) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 48(2) (1952) 142.

Materials examined. Table 2. Fig. 5E

Hedyotis longipedunculata Merr., PJS 17 (1921) 430.

Materials examined. Table 2. Fig. 7B

Erect shrub about 1 m high. Leaves oblong-ovate, 6–10 × 2.5–5.5 cm, chartaceous, glabrous. Inflorescences axillary, in clusters of 3–7 flowers attached in of 7–8 cm long peduncles. Calyces tinged purple, corolla white. Fruits as globose to oval capsules crowned with calyx, 2.5–3 mm, purple.

This species occurs along streams or very moist, low elevation areas in primary forests. It was previously only recorded at its type locality on Catanduanes Island.

Hedyotis phanerophlebia Merr., PJS 8 (1913) Bot. 34.

Materials examined. Table 2. Fig. 5D

Small, erect shrub about 2 m high. Leaves oblong-ovate, 6–7 × 2–3 cm, somewhat chartaceous, nerves very prominent. Inflorescences terminal, paniculate. Corolla

white, 3–4 mm including lobes and tube. Capsules ovoid, 7 mm in diameter, with calyx remains present.

This species was previously only recorded on the province of Misamis Occidental, Mindanao, which is far south of Samar. This species thrives on Mount Malindang where it lives in mossy forests above 1700 m in elevation. The flowers of Samar plants are much smaller than those of the type specimen (6 mm).

Spermacoce remota Lam., Tabl. Encycl. 1 (1792) 273.
Materials examined. Table 2. Fig. 6B

Tribe Urophylleae

Antherostele grandistipula (Merr.) Bremek., J. Arnold Arb. 21 (1940) 30.
Materials examined. Table 2. Fig. 5B

Tall shrub about 7–8 m high. Leaves oblong, 12–15 × 3–4 cm, coriaceous, base decurrent. Inflorescences axillary, in umbels of 2 to 4 flowers. Corolla light-green to white. Fruits globose to ovoid, 2 cm in diameter, green.

All members of the genus *Antherostele* are endemic to the Philippines. This species is occurs on Camarines Sur, Catanduanes, Samar, and Leyte, thriving in riverine habitats and along creek banks in forests. With a narrow geographic distribution which is restricted on the eastern side of the Philippine archipelago, it is thought to be Endangered (Obico and Alejandro 2012). It can be recognized from other *Antherostele* species by its very large subpersistent stipules and very large fruits.

Praravinia stenophylla (Merr.) Bremek., J. Arnold Arb. 21 (1940) 44.
Materials examined. Table 2.

Tree about 2 to 3 m high. Leaves narrowly elliptic to linear-lanceolate, 12–13 × 1.2–1.5 cm, glabrous but with scattered trichomes. Inflorescences solitary, axillary. Calyx somewhat globose, 3 mm in diameter. Corolla valvate, white, lobes 3–5 mm, tube 1 mm. Fruits not seen. This species closely resembles *P. glabra* (Merr.) Bremek, another endemic species, but is easily distinguished by its very narrow leaves.

This species was previously recorded only on Luzon at the type locality, but our observation extends its geographic distribution to Samar.

Praravinia triflora (Quisumb. & Merr.) Bremek., J. Arnold Arb. 21 (1940) 47.
Materials examined. Table 2.

Tree about 3 m high, branches densely pubescent. Leaves elliptic, 14–15 × 3.5–5 cm, pubescent, especially on the nerves. Flowers not seen. Infructescences in clusters of 3 fruits, globose, 3–4 mm, puberulous.

This species was only known from its type locality in Casiguran, Aurora, eastrern Luzon. Our new record from Eastern Samar might indicate an expansive geographic distribution across the eastern portion of the Philippines. This species thrives along streams on low elevation primary or secondary forests.

Urophyllum memecyloides (C. Presl) S. Vidal, Phan. Cuming. Philipp. (1885) 63.
Materials examined. Table 2. Fig. 5C

Shrub about 2 m high. Leaves elliptic, 13–18 × 4.5–6 cm, glabrous, chartaceous, lamina densely pored and nerves undulating when dry. Inflorescences axillary, in umbels of 5–7 flowers attached to 1.5–2 cm peduncle. Flowers globose, corolla white. Fruits not seen.

This endemic species is widely distributed on the Philippines, occurring on low- to medium-elevation primary forests.

Urophyllum urdanetense Elmer, LPB 5 (1913) 1900.
Materials examined. Table 2.

Small to medium-sized shrub about 2–4 m high. Leaves lanceolate to oblong-ovate, coriaceous. Flowers not seen. Infructescences axillary, solitary, fruits globose, red orange, with calyx remnants.

This species was only known from its type locality on Mount Urdaneta on the province of Agusan del Norte, Mindanao, where it occurrs in high elevation mossy forests. However, our record of this species in medium-elevation, primary rainforests of Eastern Samar might indicate a wider ecological preference. This species closely resembles *Urophyllum memecyloides*, another species also found in Eastern Samar, but differs in its much smaller leaves.

Tribe Vanguerieae

Canthium glandulosum (Blanco) Merr., PJS 35 (1928) 8.
Materials examined. Table 2.

Shrub about 1 m high. Leaves lanceolate, 5–6 × 2 cm, glabrous. Flowers not seen. Infructescences axillary, in clusters of 2 to 3 fruits, globose, 2 mm, glabrous.

This Philippine endemic is recorded throughout the country, occurring in low- or medium-elevation, primary or secondary forests.

Psydrax amplifolia A.P. Davis, Bot. J. Linn. Soc. 157 (2008) 120.
Materials examined. Table 2.

Shrub about 1 m high. Leaves elliptic to obovate, 12 × 6 cm, glabrous, bases decurrent. Flowers not seen. Infructescences axillary, in clusters of 3–5 fruits, 6–8 mm wide, globose, single or didymous, orange, glabrous.

This species is only known from its type locality on Mount Bulusan in Sorsogon Province. Our observation represents a new record for this species beyond its type locality.

Pyrostria elmeri (Merr.) Arriola, Meve, Alejandro, Ann. Bot. Fennici 53 (2016) 217.
Materials examined. Table 2. Fig. 4D

Shrub about 2 m high, branches droop down. Leaves oblong to oblanceolate, 10 × 3 cm, glabrous, coriaceous. Flowers not seen. Infructescence axillary, solitary, attached to 1 cm long peduncle, obovate, 10 mm in diameter, orange, glabrous.

This species was only known from its type locality on Mount Guiting-guiting on Sibuyan Island, Romblon, occurring in forests along streams. Its presence on Eastern Samar suggests an extended distribution across the Visayas Islands.

Discussion

The geological history of Samar-Leyte landmass gave rise to its highly unique and endemic flora. Its connection with Sorsogon on the north, Surigao del Norte through Dinagat island on the south, and Bohol during the Miocene Period resulted in the distribution of similar species. Only during the Post-Pleistocene period were the land connections were broken and, consequently dividing them into individual islands harboring a gradient of unique habitats and environments (Samson 1979). This drove the evolution of a rich diversity of Rubiaceae species which today occur on Eastern Samar.

We found several species that were previously documented only at their type localities outside of Eastern Samar. Thus, these records represent important new data for both Eastern Samar and for understanding the geographic distributions of these endemic species in the Philippines. Although only a single voucher for each species was taken, this does not imply that only a single individual of that particular species was observed by us. Some rare species were only encountered once or a few times during the survey.

The tribe Naucleeae had the most species found in our survey. These are easily distinguished from other Rubiaceae genera by having spherical inflorescences (Ridsdale 1979, Löfstrand et al. 2014). Members of the genus *Uncaria* Schreb. are tropical woody lianas, easily recognized by its hooks formed from reduced, modified branches (Ridsdale 1978). The *Uncaria* species observed contribute in part of the forest canopies, and of the 5 species recorded, none are endemic to the Philippines. The tribe's largest genus, *Neonauclea* Merr., contains 16 species in the country and 10 of those that are endemic. They occur as trees and shrubs with deciduous and highly ornate calyx lobes borne on well-developed appendages (Ridsdale 1989). *Neonauclea* tends to thrive along forest and river edges and in ravines and clearings at our surveyed sites. Four *Neonauclea* species were identified, with 3 of them endemic to the Philippines.

The genera *Exallage* Bremek., *Hedyotis* L., and *Spermacoce* L. belong to the complex tribe Spermococeae. This comprises an herbaceous lineage characterized by fimbriate stipules and four-merous flowers (Bremer and Manen 2000, Robbrecht and Manen 2006, Groeninckx et al. 2009). Presently, some generic delimitations within the tribe remain problematic and require taxonomic revision (Neupane et al. 2015). In the present survey, 6 species recorded belong to the tribe Spermacoceae, with 2 that are Philippine endemics. These species occur on humus-rich soil, ultramafic soil, and moist areas within the densely forested areas of our study sites. They are at abundant on the forest floor but are threatened, especially the locally-adapted species such as *Hedyotis longipedunculata* Merr. and *H. phanerophlebia* Merr., which are known to be recorded previously only on Catanduanes and Misamis Occidental, respectively.

Psychotria L. is perhaps the world's largest predominately woody genus (Davis et al. 2001) comprised of approximately 2000 species (Sohmer 1998), which are chiefly distributed in the Paleotropics. In the Philippines, 112 species are currently recognized by Sohmer and Davis (2007) in their revision of the genus within the archipelago. However, more than half are assumed extinct in the wild due to rapid habitat losses (Koopowitz et al. 1998, Sohmer 2001). In our study, we found *Psychotria* as woody shrubs to small trees in primary or secondary vegetation. Five endemic species, *P. conglomeratifolia*, *P. papillata, P. paloensis, P. radicans,* and *P. wenzelii* are threatened (Sohmer and Davis 2007), with the *P. conglomeratifolia* and *P. wenzelii* considered possibly extinct. We have now re-collected this species and can confirm that it is not extinct.

The genus *Greeniopsis* Merr. is one the few Philippine-endemic Rubiaceae genera, along with *Antherostele* Bremek. and *Villaria* Rolfe, recorded on Samar Island, and their presence on the island is associated to the geological history of the Samar-Leyte landmass (Madulid 2000). The genus *Villaria* unfortunately, was not encountered at our study sites. *Greeniopsis* is comprised of 6 species (Alejandro et al. 2010, Uy and Alejandro 2012), whereas the genus *Antherostele* is comprised of 5 species (Obico and Alejandro 2012, 2013). The species of *Greeniopsis* and the sole *Antherostele* representative, *A. grandistipula*, were observed within densely forested areas especially on humus-rich and ultramafic soils. Both genera are highly threatened due human-mediated pressures through land alterations and deforestation and thus warrant immediate protection from local extinction.

The pantropical *Ixora* L. constitutes one of the largest Rubiaceae genus in the Philippines comprising of 34 species of woody shrubs and trees, with 25 endemic species (Banag et al. 2015, 2017). Almost all *Ixora* have narrow ecological tolerances and are restricted to rainforest habitats (De Block 1998), as we observed. A recent study by Banag et al. (2015) revealed that Philippine endemic *Ixora* prefer narrow temperature and wider precipitation niches. The endemic *I. bartlingii* Elmer will have an expected range shift in their distribution southwards under predicted future climate scenarios.

Species such as *Wendlandia luzoniensis* D.C., *Dolicholobium philippinense* Trelease, *Aidia pulcherima* (Merr.) Ridsdale, *Schradera monocephala* Puff, Buchner & Greimler, *Ophiorrhiza acuminata* DC., *Tarenna luzoniensis* (S. Vidal) Bremek., *Praravinia stenophylla* (Merr.) Bremek., *Urophyllum memecyloides* (C. Presl) S. Vidal, *U. urdanetense* Elmer, and *Pyrostria elmeri* (Merr.) Arriola, Meve, Alejandro were collected mainly within forested areas generally unscathed by human

disturbances. However, continuous decrease in the sizes of these endemic species' natural populations in their native vegetation is expected to proceed as land is developed by local people. Nevertheless, some endemic species, such as *Timonius philippinensis* Merr., *Ophiorrhiza camiguinensis* Elmer, and *Mussaenda vidalii*, were observed in areas where human influence is extreme, such as the beach forests of the Minasangay Eco-park, a well-known tourist attraction and forest edges and field borders.

Occurrence reports of rare species, especially for narrow endemic taxa, are almost a century old. Thus, our rediscovery of these species extend their geographic distributions beyond their type localities and confirms that they are not yet extinct. Our new data on these endemic taxa are particularly important for evidence-based conservation management of the Eastern Samar flora.

Samar Island experienced one of the greatest forest loss within terrestrial protected areas in the country next to Palawan, experiencing a cumulative total of forest loss of 2.79% of its 442,095 ha forest area between 2000 to 2012 (Apan et al. 2017). In this context, losses in biodiversity will continue to rise as deforestation continues on Samar Island. It is crucial that more studies are made that can provide baseline information on the distribution, ecology, and biology of Rubiaceae, as well as other plant families. Updated floristic inventories and vegetation diversity analyses over time will aid in the identification of specific areas that will become priorities for conservation and protection. Optimistically, this will translate into valuable information for policy formulation and management in the conservation of the remaining biodiversity of Samar Island, and ultimately, the entire Philippine archipelago.

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Authors' Contributions

All authors contributed to the research activities accomplished in the project, including the fieldwork and manuscript preparation. Specifically, JAO, NAP, RR, and CB-M conducted the field collections, species identifications, data analysis, and writing. GA and CB-M supervised the work.

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